Scintillation Network Decision Aid

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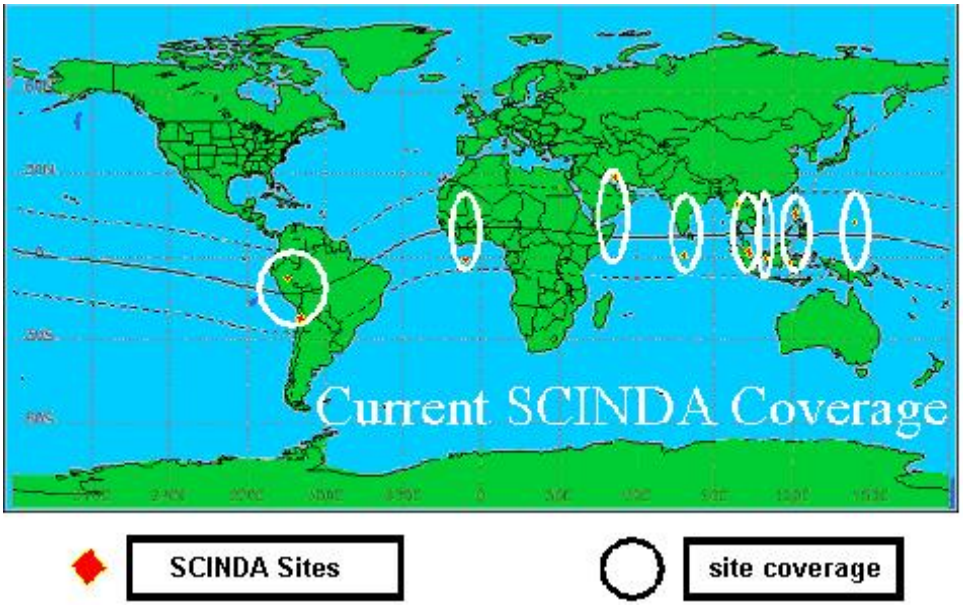
Developed for Air Force Space Command by the Air Force Research Laboratory's (AFRL's) Space Weather Center of Excellence, the Scintillation Network Decision Aid is a computer program that predicts communication satellite outages above the equator that are caused by naturally-occurring disruptions in the ionosphere.

Ionospheric disturbances can lead to rapid fluctuation or scintillation of satellite signals at or near the earth's surface. This phenomenon is most intense at night within 20 degrees of the earth's magnetic equator, which occupies more than one-third of the globe's surface. Affecting radio signals, scintillation seriously disrupts navigation and communication satellites signals. SCINDA was developed to advise operational users in real-time when and where scintillation is likely to occur.

SCINDA is now used at eleven locations: Antofagasta, Chile; Ancon, Peru; Ascension Island; Bahrain; Diego Garcia Island; Singapore; Manila, The Philippines; Fang, Thailand; Parepare, Indonesia; Pontianak, Indonesia and Guam Island. Scintillation data and ionospheric drift velocities from available satellite links are measured and stored at the remote sites. At fifteen-minute intervals, this information is retrieved by AFRL researchers and compiled to make simple tri-color maps of disturbances over the equator and the corresponding areas of likely communication outages. Such maps help scientists to better understand how scintillation structures develop and enable operators to determine practical strategies for maintaining reliable communications. The data will be combined with the C/NOFS observations to produce now-casts and forecasts of scintillation regions



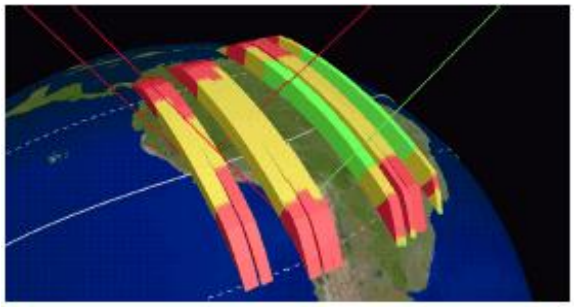
Current as of January 2005

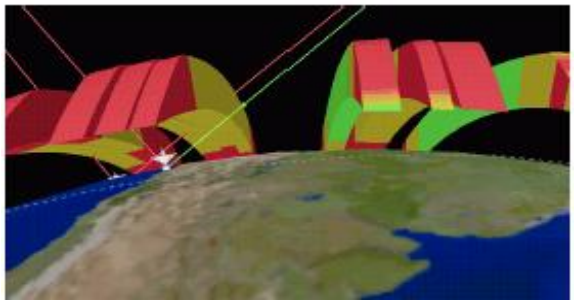
For example, based on the sample displays shown in the second figure, users near Antofagasta, Chile, would find their communication link - represented by the red line from the ground to the western sky in the figure - disrupted by the effects of scintillation.

As shown in the second and third images, communications to other satellites (in this case to the east) may be clear when the path between the ground and the satellite is between disturbed regions of the ionosphere.

In this case, communications may be maintained simply by adjusting the user's antenna.

SCINDA also allows the operator to find a desired communication link that includes ground-station coordinates, proper radio frequency, and a comprehensive satellite database complete with daily updates. The SCINDA computer model then displays color-coded communication pathways between ground stations and satellites: green if clear or red if not. Alternatively, the model can generate two-dimensional maps showing the projection of scintillation





activity from a specified satellite over an entire theater of operations.

The network is expanding geographically and 4-6 more stations throughout the equatorial region are expected. These stations will provide more real-time data and support to satellite communications users.